Cryptosporidium Source Tracking to Enhance Source Water Pollution Implementation in the Potomac River Watershed

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What is the Potomac Drinking Water Source Protection Partnership (DWSPP)?

Formed in 2004 after completion of SWAs

- Numerous common concerns among utilities (and govt) sharing Potomac River as source

Committed to working together to find efficient solutions to source water protection from "safe" water perspective

- Pathogens identified as one of priority issues

Membership currently includes:

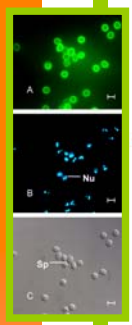
- 9 DC metro and other basin water suppliers
- 9 government agencies (state, DC, federal)

City of Frederick, MD
City of Hagerstown, MD
City of Rockville, MD
Fairfax Water, VA
Frederick County, MD
Town of Leesburg, VA
WAD/USACE, D.C.
Washington County, MD
WSSC, MD

DWSPP utilities serve nearly 4 million residents of the Potomac Basin

What We Know About Crypto

- *Cryptosporidium* oocysts are significant public health concern because they are:
  - Environmentally hardy oocysts found in most surface/some treated water (Juranek, 1995)
  - Challenge to conventional water treatment
    - Small size (4-7 µm) and surface charge
    - Resistant to conventional water disinfection practices
  - Long-lasting infectivity and low ID50
    - Significant contribution to immunosuppressed mortality (e.g., see Morgan et al., 2000)
- Human health impact is significant
  - Etiologic agent in drinking water outbreaks:
    - 1987 in Carrollton, GA (13,000 people)
    - 1993 in Milwaukee, WI (403,000 sick, 100 deaths)
    - 1994 in Las Vegas, NV (110 sick, 19 deaths)
  - At least first 6 waterborne outbreaks occurred even though utilities met SDWA standards and included filtration for surface water sources
  - Chief etiologic agent in treated recreational water outbreaks in 1999-2000 (CDC, 2000)

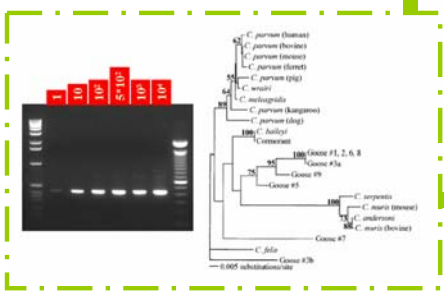


Research Objective: Answer Unknowns

- What are sources?
  - Identify significant sources of *Cryptosporidium* in Potomac basin
- Where, when, and how much?
  - Obtain more accurate *Cryptosporidium* oocyst counts and build on previous monitoring data if possible (e.g., Maryland Dept of Environment *Crypto* study)
  - Develop improved understanding of relationship between hydrologic conditions and oocyst sources and concentrations

What is Proposed Research Approach?

- Source-tracking monitoring program
  - Use nested PCR (amplification of hypervariable region of 18S rRNA gene) for genotype/source
    - Allows qualitative identification of specific genotypes/hosts of *Crypto* oocysts
    - Very sensitive to low concentrations of oocysts
    - Has been used in watersheds for MWRA, PWD, NYC
  - Use EPA Method 1622/1623 for quantification and compare w/ other methods (CAM/FISH?)
  - One to three-year monitoring program
    - Monthly or bi-weekly samples from 4 priority subwatershed locations (representing major ag and urban land uses) and 2 WTP intakes
      - Fecal samples also to be collected in subwatersheds
    - Base-flow and storm-flow (hydrograph) sampling at each location
    - Regular split samples for genotype and quantification analyses



What We Do Not Know About Crypto

- Where, when, and how much in Potomac?
  - Existing data limited; confirms *Crypto* is present in source water, possibly at significant levels
  - Most data not correlated with hydrologic events
- What are major sources of human health concern for Potomac WTPs?
  - Data does not indicate sources and generally does not identify species and human infectivity
  - Source tracking necessary for considering and focusing source protection efforts

Benefits to Region 3 and Others

- Region 3
  - Identify most significant hosts/sources contributing to *Cryptosporidium* loads:
    - At wastewater treatment plant intakes
    - In priority subwatersheds
    - By land-use
  - Assess level of risk from *Crypto* (i.e., human-infectious or not)
  - Will be used to assess and focus source protection efforts on significant sources
- Other regions
  - Contribute to state of knowledge of *Crypto*
    - Major source and human infectivity identification
    - Land-use relationships
    - Improved quantification
  - Provide lessons for future applications of same approach